

3.0 PLAN FORMULATION

3.1 INTRODUCTION

Plan formulation is an iterative process that establishes planning objectives, evaluates management measures that address these objectives, develops potential alternatives that meet the objectives, screens out plans based on comparison criteria, and identifies plans for implementation. This process is consistent with the planning requirements of the Water Resources Council's Principles and Guidelines, the National Environmental Policy Act of 1969, and the U.S. Army Corps of Engineers Planning Guidance Notebook. The process requires systematic development and evaluation of alternatives for alleviating problems and realizing potential opportunities.

This section has two purposes. First, it describes the formulation, evaluation and screening of management measures that address the planning objectives. Second, it describes the formulation of a final array of plans, which display trade-offs between different combinations of management measures. The plans in this final array are candidates for possible recommendation for implementation.

The formulation of the restoration alternatives for the expansion of the HWRP to include BMKV was accomplished through a series of project design team meetings involving staff from the California SCC, the Corps, and BCDC. Input from members of the public, interested organizations, and local, state and federal agency staff was also considered in the development and evaluation of alternatives. Selection of practicable alternatives was based on (1) regional and project-specific goals and objectives; (2) site-specific opportunities and constraints; (3) potential costs and benefits; and (4) potential adverse environmental effects. Plan formulation focused on major design elements (e.g., habitat acreages); minor design elements (e.g., alignment of the Bay Trail) that do not substantially affect the overall design and function of the project will continue to be refined based on public and stakeholder input.

3.2 PLANNING OBJECTIVES

3.2.1 National Objective

Ecosystem restoration is one of the primary missions of the Corps of Engineers Civil Works program. The Corps objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to national ecosystem restoration (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units). These net changes are measured in the planning area and in the rest of the Nation. Single purpose ecosystem restoration plans shall be formulated and evaluated in terms of their net contributions to increases in ecosystem value (NER outputs), expressed in non-monetary units.

3.2.2 Project-Specific Objectives

The national objective is a general statement and not specific enough for direct use in plan formulation. The planning objectives are directly related to identifying the problems and opportunities and represent desired positive changes in the without project condition. The planning objectives for this GRR are as follows:

- To design and engineer a restoration project that stresses simplicity and has little need for active management.
- To demonstrate the beneficial use of dredged material, if feasible.
- To recognize existing opportunities and constraints as integral components of design.
- To ensure no net loss of wetland habitat presently provided at the BMKV and HAAF sites.
- To create and maintain wetland habitats that sustain viable wildlife populations, with particular emphasis on supporting Bay Area special-status species.
- To include buffer areas along the upland perimeter of the project area, especially adjacent to residential areas, so wildlife will not be impacted by adjacent land uses.
- To be compatible with adjacent land uses and wildlife habitats.
- To provide for public access that is compatible with protection of resource values and with regional and local public access policies.

In 1996, the National Marine Fisheries Service (NMFS) convened a group of federal and state agency representatives to explore the concept of restoring the HAAF site to tidal wetlands. This group was later expanded into the Hamilton Restoration Group, an advisory body composed of representatives from the City of Novato, state and federal agencies, local landowners, environmental and local interest groups, and other interested parties. The overall project goal is as follows:

To create a diverse array of wetland and wildlife habitats at the HWRP sites that benefit endangered species as well as other migratory and resident species.

3.3 DESIGN MEASURES

A range of measures was developed for consideration, based in part on input received from the technical and public workshops conducted in Fall 2001. These measures incorporated various options to meet the project purpose and need as well as options to avoid or reduce some of the potential impacts of certain aspects of habitat restoration at the BMKV site. The full range of measures developed was evaluated for feasibility; ability to satisfy the stated project purpose, need, goal, and objectives; and potential environmental effects. Based on this evaluation, a number of measures were dismissed from further consideration; the reasoning for dismissing these measures is discussed for each of the types of measures, below. The measures described here focus on measures applicable to the reauthorization of HWRP to add the BMKV parcel. Measures applicable solely to the currently authorized project are not reanalyzed in this GRR.

3.3.1 Modification of Site Elevation

The majority of the authorized project site and the BMKV parcel have subsided significantly from its historic elevation since being diked off. The typical elevation is -5 feet NGVD. An elevation of +2 feet NGVD is necessary for the establishment of tidal marsh. This GRR considers both the use of suitable dredged material and natural sedimentation processes to bring the site to the desired elevation.

3.3.1.1 Natural Sedimentation

If the BMKV parcel were returned to the tidal action of San Pablo Bay, sediment would accrete by natural processes, and marsh plain elevations would eventually be reached. Complete restoration of tidal wetlands by natural sedimentation is estimated to take up to 50 years.

Restoration of tidal wetlands by natural sedimentation is effective, albeit slow, and is being considered further. Restoration of tidal wetlands by natural sedimentation was evaluated for the authorized project, but was not part of the selected plan.

3.3.1.2 Use of Dredged Material

The use of dredged material for wetland restoration projects is a beneficial reuse of sediment resources with a net positive environmental effect. Reuse of dredged materials reduces public concern regarding the potential cumulative environmental impacts associated with aquatic dredged material disposal and is consistent with the goals and objectives of the federal and state resource agencies in the region. The authorized project includes use of dredged material to raise site elevations as a major design feature.

One important advantage of using dredged material is the reduction in the amount of time necessary for restored wetlands to become fully functional. This is especially true in the back portion of the parcel/marsh. By filling the restoration site with dredged material, the overall sediment deficit for the system is reduced and velocity gradients are more gradual across the site. With less of the supply being deposited near the inlet, more sediment will be available to the back marsh. The sediments will be more uniformly transported and distributed within the system, and sedimentation will progress more rapidly toward the back marsh. In addition, by filling the restoration site with dredged material, a local sediment supply is established for the back marsh. During tidal channel formation, sediments placed within the system will be redistributed as sediments are scoured from higher-order tidal channels and redeposited in marsh plain areas throughout the site.

Another advantage in using dredged material is that it would allow the creation of design features such as a wildlife corridor connecting habitats to the north and south, tidal pannes, and transitional habitat along the edge of the marsh. The addition of these features would provide a more diverse tidal marsh habitat than would be restored with natural sedimentation alone.

Use of dredged material was considered further because it is consistent with LTMS guidelines, it restores endangered species habitat much sooner than natural sedimentation, and it allows for the restoration of a more diverse tidal marsh ecosystem that would be more efficient to maintain.

3.3.2 Novato Sanitary District Facilities

A Novato Sanitary District treated wastewater pipeline runs along HAAF's northeastern boundary extending between the HAAF and SLC sites to an outfall in San Pablo Bay. The Novato Sanitary District (NSD) serves 60,000 people with two connected treatment plants. During the dry season, treated wastewater is used for spray irrigation on a 1,000-acre reclamation facility along Highway 37. During the wet season, treated wastewater is discharged into San Pablo Bay through the pipeline and outfall. The NSD outfall pipeline runs through a 20-foot wide easement for two miles along the northeast boundary of HAAF and southwest boundaries of the SLC and BMKV parcels. A dechlorination facility is located 1300 feet west of the outboard levee. The outfall extends past the outboard levee into San Pablo Bay, discharging into shallow water. The dechlorination facility lies in an area that will be inundated by sediment and tidal action.

In addition to the currently planned alignment for the authorized HWRP, expansion to include the BMKV parcel allows for two additional pipeline alignments including: routing the pipeline along the central crossing levee or the BMKV/Novato Creek levee (northern alignment), and routing the pipeline along one of the drainage divides between the tidal cells (drainage divide alignment). The alternative routings would permit lowering the existing BMKV/Hamilton berm to allow integration of the tidal marsh restoration areas over time. Either routing would require ongoing maintenance of an access road, and construction of a new outfall to San Pablo Bay.

3.3.2.1 Northern NSD Alignment

The alignment along the northern side of the BMKV site was dismissed from further consideration for the following reasons: except for a potential breach location, a berm for an access road along Novato Creek would remain in place, preventing the integration of the restored tidal wetland with Novato Creek; installation of the new pipeline would require disturbance to the outboard marsh; and location of the outfall near the mouth of Novato Creek could affect water quality in the creek.

3.3.2.2 Drainage Divide NSD Alignment

The alignment along the drainage divide between the new northern tidal cell and the adjacent cell was dismissed from further consideration for the following reasons: this alignment would require construction of a berm for an access road along the drainage divide, which would segregate the northern tidal cell from the rest of the site; additional construction would be necessary for the new berm; and the new outfall would be located closer to the mouth of Novato Creek and could affect water quality in the creek.

3.3.2.3 Currently Planned Alignment

Although constructing the new pipeline along the existing alignment (consistent with the authorized project) would require ongoing maintenance of most of the BMKV/HAAF berm to ensure continuing access for maintenance of the NSD line, the HAAF and the BMKV sites are believed to encompass sufficient tidal marsh acreage to buffer the segregation effects of the NSD line. **Therefore, this measure was carried forward and was considered further.** In addition,

the existing outfall location is as far as possible from the mouth of Novato Creek. If future changes in wastewater routing or treatment technology eliminate the need for this outfall, it might be possible to lower the berm to promote better integration of the sites.

3.3.3 Levees

The project site is neighbored by several properties currently in a variety of uses such as residential, agricultural, recreational, light industrial and wildlife habitat. Actions must be taken to prevent flooding of these properties. The following measures were considered.

3.3.3.1 Staged Construction

As the site is underlain by Bay Mud that is highly compressible, the design must account for settlement of the levees that will occur over time. An alternative design measure, staged construction, was evaluated to address the settlement issue. Staged construction of the levees was considered to recognize the time value of the project investment cost and result in much lower total present value and average annual costs. In addition, staged construction would minimize visual impact to the existing BMK residential community by limiting the levee heights. If staged construction were employed, levee material would have to be temporarily stored on site for future use in levee staged construction as the restored habitat would cover the borrow sites. This would allow the use of on-site borrow without importing fill material. While, staged construction would likely impact the restored habitats, endangered species, and other fish and wildlife that would reside there, **staged construction merits further consideration as this would address the visual impact issue important to the BMK residential community.**

3.3.3.2 Perimeter Levees

To protect the adjacent areas from being flooded once the site was restored to tidal action, the project would require levee construction all around the upland perimeter of the new wetlands except where they would abut the recently constructed NHP levee or higher ground. The new perimeter levee would be designed to replace the level of protection provided by the existing bayfront levee, which would be graded down to high marsh plain elevation by the restoration project.

Existing perimeter levees may need to be improved to facilitate the placement of dredged material and/or provide flood protection. The perimeter containment levees will be used as access roads and will be engineered to support vehicle loads. The levees will also be used to support the delivery pipeline for dredged materials. **Construction of new perimeter levees and improvement of existing perimeter levees was carried forward and was considered further.**

3.3.3.3 Flood Protection Levees

To ensure flood protection for existing communities, flood protection levees were carried forward and considered further. Flood protection levees will be constructed across the western portion of the site to protect the adjacent community from tidal inundation and to create additional open-water habitat. The levees will be designed and constructed to appropriate level of protection. They will typically have gradual side slopes and will be engineered to support

vehicle loads and prevent excessive seepage. Please see Figure 3-12, New Levee Structure, of the attached Supplemental EIS/R.

3.3.3.4 Phase Containment Levees.

Prior to transporting and placing dredged material, a series of internal levees may be constructed within the project site to facilitate phasing. The site will be divided into sub-units based on drainage basin size and configuration. The phase levees will be used as access roads and will be engineered to support vehicle loads. The levees will also be used to support the delivery pipeline for dredged materials. These levees will be degraded to intentional levels once sub-unit construction is complete. Since these levees will be site-specific designs, no typical cross-section is shown. **This measure was carried forward and considered further.**

3.3.3.5 Extend Tidal Reach to Pacheco Pond

Elimination of the levee separating Pacheco Pond from BMKV and construction of no central crossing levee would be feasible if dredged material was placed as fill to raise the existing site grade on BMKV and at Pacheco Pond. Under this scenario, tidal flow would affect the entire pond, changing the existing brackish environment, and could extend farther upstream into Pacheco Creek and Arroyo San Jose. **This measure was dismissed from further consideration for the following reasons:** existing brackish and freshwater environments would be lost; it would conflict with the existing Marin County Flood Control and Water Conservation District-Department of Fish and Game agreement about maintenance of brackish habitat at the pond; and it would not create a diverse array of habitats.

3.3.3.6 Removal of Berm Separating BMKV and HWRP

Complete removal of the berm separating BMKV and the HWRP site would allow integration of the restored tidal marsh and seasonal wetland environments. **This measure was dismissed from further consideration because of the need for the expansion project to accommodate the existing NSD outfall pipeline and the potential replacement pipeline and permit periodic maintenance of the existing and future outfall.**

3.3.4 Internal Peninsulas

Internal peninsulas would be constructed to reduce fetch length on the expanded HWRP site. These peninsulas are needed to reduce internal wave energy during both typical and extreme storm conditions. These peninsulas would also direct the formation of the main tidal channels and thus would protect the perimeter levee system from erosion by these channels. Please see Figure 3-12, Internal Peninsulas of the attached Supplemental EIS/R. **Use of peninsulas has been carried forward for further consideration.**

3.3.5 Breach Options

Breaching the outboard levee that separates the SLC, HAAF and BMKV sites from San Pablo Bay tidal waters is necessary to re-introduce tidal action. Four breach options have been considered in this report.

3.3.5.1 Single Channel Cut for Each Tidal Basin

The option of single channel cuts to each tidal basin has been continued through the evaluation process. In addition to the two cuts for the authorized Project (one cut to the SLC basin and one cut to the HAAF basin) there would be one or two cuts for the BMKV parcel. **This measure was carried forward and considered further.**

3.3.5.2 Single Large Basin, Single Breach

This measure would design the tidal portion of the site with only one basin and one breach for the entire project. This design would reduce the area of existing tidal marsh and mudflat that would be lost due to the creation of new tidal channels. A single basin could be between 1,000 and 1,400 acres in size. Based on experience with other wetland restoration projects and understanding of the hydrology of existing tidal marshes, there are concerns about whether a single breach would be capable of providing sufficient tidal flows to promote natural channel formation and to provide full tidal exchange to a basin of this size. A further concern is that use of a single breach/single basin would not allow a phased approach to completing and opening cells to tidal action. In addition, the option of one main channel cut for all parcels would not satisfy the objective to protect Novato Sanitary District's sewage outfall line by maintaining an access berm between the two portions of the restoration site. **This measure was dismissed from further consideration because of this potential failure to provide hydraulic and biological functionality on restored wetlands.**

3.3.5.3 Many Small Channels

The option of using many small channels to introduce tidal action to the project site was rejected because it results in the maximum impact on the outboard marsh and is less efficient for providing tidal exchange. In addition, a single breach to each sub-basin is desired to promote formation of large subtidal channels that increase wetland complexity and provide habitat for special status species.

3.3.5.4 Breach Location on Novato Creek Near BMK Lock

A breach could be located on Novato Creek near the existing BMK navigational lock. **This breach option was dismissed from further consideration because it would conflict with the provision of an upland buffer adjacent to the BMK residential area and lagoon, and would place tidal marsh habitat in close proximity to residential and recreational users.**

3.3.6 Reclaimed Wastewater

Reclaimed wastewater from either the NSD or the Ignacio Sanitary District could be used to enhance freshwater flows to the expansion restoration site. **This measure was dismissed from further consideration for the following reasons:** flow augmentation would not be necessary to achieve the desired wetland habitats on the site; using reclaimed wastewater in a wetland project adjacent to a residential area has the potential to raise water quality issues; and reuse of wastewater is not among the purposes of this proposed expansion.

3.3.7 Bay Trail Alignments

3.3.7.1 Western Bay Trail Alignment

One Bay Trail alignment would be to extend the Trail northward along the west side of Pacheco Pond to Bel Marin Keys Boulevard. The trail would continue northwest along the western edge of the HWRP restoration area, proceed around the base of Ammo Hill on existing dirt roads, and cross the confluence of Pacheco and San Jose Creeks where they enter Pacheco Pond. This would require the installation of bridges, boardwalks, and/or other infrastructure. After crossing the confluence, the trail would follow the existing MCFCWCD service road and connect to Bel Marin Keys Boulevard via a boardwalk or bridge. **This measure has been carried forward for further consideration.**

3.3.7.2 Eastern Alignment

An alternative alignment considered consists of a trail that follows the existing Pacheco Pond levee, connecting the proposed Bay Trail segment along the southwest boundary of the HAAF parcel to Bel Marin Keys Boulevard. A permanent bridge would be installed to facilitate access across the new weir structure. **This measure was carried forward and considered further.**

3.3.7.3 Outboard Levee Bay Trail Alignment

Another alternative alignment considered consists of a Bay Trail alignment along the San Pablo Bay and Novato Creek outboard levees. It would require pedestrian bridges over breaches in the levee, and would necessitate maintenance of levee integrity. **The outboard levee alignment was dismissed from further consideration for the following reasons:** it is inconsistent with the proposed Bay Trail alignment; it is inconsistent with the authorized HWRP; it would prevent lowering of the outboard levees to allow integration of the restored tidal wetlands with Novato Creek and San Pablo Bay; it would likely result in public access conflicts with threatened and endangered species and their habitats; it is inconsistent with current City of Novato planning for the Bay Trail; and it would generate long-term management costs.

3.3.7.4 Bay Trail Spur

An optional spur of the Bay Trail would be located along the proposed levee separating the upland buffer/swale area from restored tidal wetlands. This spur would terminate at Novato Creek, and a gate would be installed at the Novato Creek terminus to prevent trail users from entering the BMK residential area. **This alignment measure was considered further.**

3.3.8 Alternative Site Location

Because the scope of this study is limited to modifying the already authorized HWRP, it would be inappropriate to consider any sites that are not contiguous with the HWRP site. **Therefore, this measure was dismissed from further consideration.**

3.3.9 Flood Control

3.3.9.1 Flood Control Measure 1

This measure was suggested by MCFCWCD for analysis. This alternative was described in the 1993 EIR prepared for the residential and golf course proposal at BMKV and was as a means of reducing peak flood stage at Highway 37 to 7.0' NGVD to provide an equivalent to the "ultimate channel" described in the Marin County flood control ordinance (Environmental Science Associates 1993). This measure would route Novato Creek flood flows through the BMK south lagoon by taking water, via culvert, when stage on Novato Creek reaches 7.0' NGVD, and then discharging to a large detention basin on the BMKV parcel. The detention basin would be closed to tidal action and would be designed to drain at low tide. This measure would include construction of an additional culvert from Novato Creek to the BMK south lagoon at the location of the three western culverts between the creek and the lagoon and construction of conveyance structures from BMK south lagoon to the detention basin and the detention basin to San Pablo Bay.

Flood control (outside of mitigation were significant adverse physical effects on flooding identified) is not a purpose of the HWRP or the BMKV expansion. As described in Chapter 4 of the attached SEIR/S, the hydrologic and hydraulic analysis concluded that the three restoration alternatives selected for analysis in this document would not have a physical adverse effect on flooding, and that even if it is determined that the project is inconsistent with the local flood zoning ordinance, that this is not a significant effect on the environment. Thus, a flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. Further, maintenance of a large portion of the site as a detention basin would severely limit the amount of the site that could be restored to tidal wetlands or other habitats, which would not meet the goal and objectives of the project. **Thus, after consideration, this measure was dismissed from further analysis in this document.**

3.3.9.2 Flood Control Measure 2

This alternative feature was also suggested by MCFCWCD for analysis and was described in the 1993 EIR prepared for the residential and golf course proposal at BMKV. This measure was proposed as a means of reducing peak flood stage at Highway 37 to 7.0' NGVD as a means to provide an equivalent to the "ultimate channel" described in the Marin County flood control ordinance (Environmental Science Associates 1993). This alternative feature would include widening Novato Creek from Highway 37 to San Pablo Bay using a by-pass channel near Highway 37 and moving the existing north-side levees northward to expand the existing channel. In order to maintain the initial channel capacity in the by-pass channel and main channel, maintenance dredging would be required, probably on the order of something like every 10 years (or less).

Flood control (outside of mitigation were significant adverse physical effects on flooding identified) is not a purpose of the HWRP or the BMKV expansion. As described in Chapter 4, of the attached SEIS/R, the hydrologic and hydraulic analysis concluded that the three restoration alternatives selected for analysis in this document would not have a physical adverse effect on flooding, and that even if it is determined that the project is inconsistent with the local flood

zoning ordinance, that this is not a significant effect on the environment. Thus, a flood control feature is not necessary as mitigation because no significant physical adverse effect has been identified. This measure would result in significant change in the habitats within the lower portion of the Novato Creek, which includes tidal salt marsh habitat that supports threatened and endangered species. Destruction or alteration of existing special-status species habitat in Novato Creek to build the bypass channel or widening the existing channel is not necessary to conduct the restoration project and is actually counter to the goal of the project, which is to increase the amount of habitat for special-status species. The Novato Sanitary District uses the fields north of Novato Creek as spray-irrigation fields for treated wastewater and construction of new levees or a bypass channel could obstruct this use. These lands are also not under the control or ownership of the project sponsors. **Thus, after consideration, this alternative feature was dismissed from further analysis in this document.**

3.3.10 Access Area

In accordance with Policy Guidance Letter 59, an access area required for a parking lot, restrooms and a kiosk will be located on a 2-acre portion of the ‘bulge’ property, just west of the HAAF panhandle. This feature will enhance educational and recreational use of the expanded HWRP and by providing proper access, will deter improper excursions into the endangered species habitat. **This measure was carried forward.**

3.3.11 Additional Measures

With the measures described above, there are design requirements that must be included for the formulation of complete alternative plans. These measures include provision of an access road for construction equipment and site maintenance, breaching and removal of the bayfront levee, and demolition of remaining outbuildings. **These measures were carried forward.**

3.3.12 Summary of Measures Dismissed from Further Consideration

Based on input received from the technical and public workshops conducted in Fall 2001, a range of measures was developed for consideration. These measures incorporated various options to meet the project purpose and need as well as options to avoid or reduce some of the potential impacts of certain aspects of habitat restoration at the BMKV site. The full range of measures developed was evaluated for feasibility; ability to satisfy the stated project purpose, need, goal and objectives; and potential environmental effects. Based on this evaluation, the following measures were dismissed from further consideration:

- Northern and Drainage Divide Novato Sanitary District Wastewater Alignments
- Extend Tidal Reach to Pacheco Pond
- Removal of Berm Separating BMKV and HWRP
- Single Large Basin, Single Breach
- Many Small Channels
- Alternative Breach Location on Novato Creek
- Reclaimed Wastewater

- Outboard Levee Bay Trail Alignment
- Alternative Site Location
- Flood Control Measures 1 and 2

3.4 PRELIMINARY ALTERNATIVES

The measures described above were combined into a series of alternatives. The alternatives encompass the range of viable measures. The focus in alternative formulation was on the major design elements (such as the sewer line location and habitat mix), minor design elements (such as the Bay Trail alignment) are also evaluated, but may be refined through public input as the study proceeds.

3.4.1 No Action

The No Action plan is the "without-project" condition that serves as the basis for developing and comparing the impacts of preliminary and candidate plans. Under the No Action Plan of this GRR, the Hamilton Wetland Restoration Project would proceed as authorized, without BMKV, and with potential delays to implement the SLC component (314 acres), the Navy Ballfields (18 acres) and the seasonal wetland portion of HAAF due to uncertainties related to HTRW remediation. If the HWRP is not reauthorized to include BMKV, the SCC would continue to allow use of the site for agricultural production for a few years. Following agricultural use, the site would remain inactive; the SCC would implement a maintenance program to control weeds and retain the integrity of fencing. The perimeter levees would be maintained as flood control levees and would not be breached; natural sedimentation would not occur. If the project site continues to be used in this manner, ground-surface settlement would likely continue to occur at its existing rate. Substantial alteration of natural topography and loss of soil resources capable of supporting sensitive wetland habitats would likely occur. The without project condition assumes that navigation projects will utilize the disposal sites designated under the LTMS implementation plan, as provided in Article II.F. of the HWRP PCA. Please see Appendix A for a detailed description. **This alternative was carried forward and was considered further.**

3.4.2 Beneficial Reuse of Dredged Material with Enlarged Pacheco Pond

This alternative was carried forward and was developed into Alternative 1 in the final array of alternatives. Please refer to Section 3.5 for a detailed description of this alternative.

3.4.3 Beneficial Reuse of Dredged Material with Seasonal Wetlands

This alternative was carried forward and was developed into Revised Alternative 2 in the final array of alternatives. Prior to the public review period, Alternative 2 was entitled 'Beneficial Reuse of Dredged Material with Seasonal Wetlands.' In response to public comments, this alternative was modified. Revised Alternative 2 is entitled 'Beneficial Reuse of Dredged Material with Seasonal Wetlands and Enlarged Pacheco Pond.' Please refer to Section 3.5 for a detailed description of the revised alternative; please refer to Appendix J for a description of Alternative 2, as described prior to the public review period.

3.4.4 Natural Sedimentation

Although the use of natural sedimentation does not meet one of the primary project objectives, beneficial reuse of dredged material, as a response to public interest, natural sedimentation was carried forward to demonstrate its rank in comparison with other alternatives. This alternative was developed into Alternative 3 in the final array of alternatives. Please refer to Section 3.5 for a detailed description of this alternative.

3.4.5 Hybrid of Dredged Material and Natural Sedimentation Approaches

Representing a “middle ground” between the dredged material placement and natural sedimentation measures, this alternative would place dredged material to create appropriate elevations for wetland restoration on a part of the site, and would rely on natural sedimentation for wetland restoration on the remainder of the site. **This alternative was dismissed from further consideration because it does not fully utilize the site for beneficial reuse of dredged material.** If a dredged material placement alternative is selected for implementation and the availability of dredged material of suitable quality becomes a limiting factor at some point in the future, this alternative may be reevaluated.

3.4.6 Habitat Distribution

Habitat distributions considered for the BMKV parcel ranged from: 1) leaving the site in its present state; 2) providing less tidal marsh habitat and more seasonal marsh habitat; 3) providing only tidal marsh habitat; to 4) providing only seasonal wetland habitat.

3.4.6.1 Only Seasonal or Only Tidal Marsh Habitat

The goal of the project is to create a diverse array of wetland and wildlife habitats at HWRP and BMKV to benefit a number of special-status species as well as other migratory and resident species. **Consequently, the “all or nothing” alternatives, such as providing only tidal marsh habitat, were dismissed from further consideration because they would fail to provide a diversity of habitat.**

3.4.6.2 Greater Seasonal Wetland with Less Tidal Marsh

One of the needs for the HWRP is to provide habitat for endangered species. In the context of San Francisco Bay, this means providing habitat for endangered tidal marsh species, such as the salt marsh harvest mouse and the California clapper rail. **Thus, alternatives that did not provide for restoration of substantial areas of tidal marsh were also dismissed from further consideration.** Although a nearly infinite range of possible habitat distributions remain, the distributions selected for detailed evaluation represent a reasonable range of habitat options, and other distributions offering different percentages of the various habitat types were dismissed from further consideration. Whether seasonal wetland habitat could be created depends on the construction method selected – the natural sedimentation measure will not result in the creation of any seasonal wetlands.

3.4.6.3 Historic Bay/Wetland Restoration

Another habitat distribution alternative considered was restoration of the site to “historic” (pre-Gold Rush) conditions. Circa 1850, the Bay shoreline was located near the eastern edge of the BMK south lagoon. Approximately half of the current BMKV site was part of the Bay at that time, while the western remainder of the site supported a tidal marsh complex that received freshwater flow directly from Pacheco Pond and Arroyo San Jose as well as overflow from Novato Creek. It would be possible to restore this circa-1850 habitat mosaic by constructing a new outboard levee along the approximate alignment of the 1850 shoreline, lowering the existing outboard levees, and placing dredged materials as fill or allowing natural sedimentation to create new tidal marsh on the western half of the site. Arroyo San Jose and Pacheco Pond would be rerouted from the outlet at Pacheco Pond to discharge into the restored wetland area. **This alternative was dismissed from further consideration because it would create far less tidal marsh habitat than measures employing habitat restoration on the entire site, and thus would not meet the project objectives as well as other habitat distribution measures.** The habitat distributions retained for analysis are shown in Table 3-1.

3.4.6.4 In-Kind Replacement of Agricultural Wetlands

The 1997 LSA wetland delineation, which was certified by the Corps, identified 155 acres of nonagricultural jurisdictional wetlands and 151 acres of jurisdictional agricultural wetlands. The 151 acres of agricultural wetlands identified in the delineation represent a statistically derived estimate of average ponding acreage within the cultivated fields. Flooded fields provide foraging and resting habitat for a wide diversity of wintering and migrant shorebirds, waterfowl, and other water birds during winter.

One of the identified objectives stipulates that the project shall incur no net loss of wetland habitat presently provided at the BMKV and HWRP sites (see Chapter 1). The preliminary design phase examined several means of achieving this goal. Analysis of “no net loss of wetland habitat” for wetland restoration projects in diked former baylands that are used for agriculture poses unique questions for project sponsors. Acreage is the measure historically used in discussions of compensatory mitigation related to the Corps’ national “no net loss” policy, primarily because it has been difficult to identify a single standard for all of the functional components considered during the physical and ecological evaluation required for decision making. “No net loss” is most broadly interpreted as requiring replacement of any lost wetland acreage at a ratio of at least 1:1. Exact in-kind replacement would require retention of at least 151 acres in agriculture and creation of appropriate surface topography to allow those 151 acres to pond every year. Preservation of agricultural activity would likely result in conflict between agricultural use and the protection and enhancement of resources and would require maintenance of these areas, which does not meet the HWRP objective of minimizing active management. Moreover, ponded agricultural habitat is not considered a limiting factor for wildlife along the northern rim of San Pablo Bay. Therefore, creation of exact in-kind replacement of agricultural wetlands was dismissed from further consideration.

While “no net loss” remains Corps policy, as described in the October 31, 2001 Regulatory Guidance Letter, more focus is now being placed on ecosystem approaches to the resource needs of adjacent and surrounding watersheds in developing appropriate mitigation (U.S. Army Corps

of Engineers 2001). In-kind replacement of the 151 acres of agricultural wetlands by creating/restoring seasonal wetlands is feasible at the site. However, any additional seasonal wetland acreage at the site would be created/restored at the expense of acreage that could be devoted to restoring tidal marsh for the benefit of tidal marsh–dependent species, including special-status species. **The alternative consisting of complete in-kind restoration using seasonal wetlands was dismissed from further consideration because it would result in an alternative that would decrease the acreage of tidal marsh created at the site in order to provide acreage of a lower-priority habitat that is not thought to be a limiting factor for wildlife species in and around San Pablo Bay.**

3.4.7 Smaller Restoration Project

A smaller restoration project would include placement of dredged material, establishment of levees and tidal breaching on a far smaller portion of the BMKV site than envisioned in the final array of alternatives. The purpose of this alternative would be to avoid filling, leveeing, placing structures, or undertaking any other activity that would result in diminishment of the nominal ponding capacity of the site by greater than 25%, while maintaining the acreages of existing drainage agreements. The end result would be a restoration area of approximately 317 acres in size. This alternative could comply with the county flood zoning ordinances and existing drainage agreements. Levee structures, maintenance of buffer areas, and a potential Bay Trail alignment would reduce further the available area for wetland restoration. This alternative would result in far fewer benefits to endangered and other wetland-dependent species and would only represent a marginal addition to the habitat value over the HWRP. Further, this alternative does not meet the intent of the Conservancy when it purchased the property, nor the intent of the Corps in early consideration of the potential to add BMKV to the HWRP. **After completion of hydrologic study on the BMKV site and the final array of alternatives showed that the expansion would not have an adverse effect on flooding in the local area, this alternative was dismissed from further analysis.** A second hydrologic study is being conducted on a broader study area to confirm the results of the first study. If this second study identifies an adverse physical hydrologic impact of the restoration alternatives analyzed in this document, then this alternative may be reconsidered. In addition, if resolution of the F-2 zoning cannot be reached in a way that allow any of the alternatives in the final array to proceed, this alternative may be reconsidered at some point in the future.

3.5 FINAL ARRAY OF ALTERNATIVES

For the purpose of the GRR, it is assumed that Alternative 5, the selected and authorized alternative plan for the HWRP, will be implemented. All alternatives developed for this GRR were evaluated in conjunction with the authorized alternative for the HWRP. The authorized HWRP project combined with the without project condition for the BMKV parcel represent the No Action Alternative for this GRR.

In addition to the No Action Alternative, three alternatives, representing a range of potential actions, were developed to incorporate the BMKV parcel into the authorized project:

- Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond
- Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond
- Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond.

These were selected as representing a reasonable range of measures for analysis in the GRR. Table 3-1 provides an overview of the three action alternatives for the BMKV increment; *the BMKV increment combined with the existing authorized project represents the entire alternative for reauthorization.* The three action alternatives and the No-Action Alternative are described in greater detail in the text that follows.

Table 3-1 Description of the BMKV Increment for Action Alternatives Considered in this GRR

	No Action	Alternative 1	Alternative 2	Alternative 3
<i>Descriptive Name</i>	No Action	Dredged Material Placement with Enlarged Pacheco Pond	Dredged Material Placement with Seasonal Wetlands and Enlarged Pacheco Pond	Natural Sedimentation with Enlarged Pacheco Pond
<i>Construction Approach</i>	HWRP as authorized	Dredged material placement	Dredged material placement	Natural sedimentation
<i>Design Elements</i>				
Pacheco Pond Expansion	No	Yes	Yes	Yes
Outboard Levee Breaches	1 to San Pablo Bay (SLC) as authorized	2 to San Pablo Bay (BMKV and SLC) and 1 to Novato Creek (BMKV)	1 to San Pablo Bay (BMKV) and 1 to Novato Creek (BMKV)	2 to San Pablo Bay (BMKV)
Habitats	None	1,039 acres tidal wetland 147 acres subtidal and tidal mudflat habitat 40 acres seasonal wetland 10 acres emergent wetland 40 acres open water (pond) 300 acres upland	899 acres tidal wetland 120 acres subtidal and tidal mudflat habitat 277 acres seasonal wetland 12 acres emergent wetland 21 acres open water (pond) 247 acres upland	1,274 acres tidal wetland 197 acres subtidal and tidal mudflat habitat 10 acres emergent wetland 40 acres open water (pond) 55 acres upland
Novato Sanitary District Outfall* (See SEIR/S, Figure 3-12 & 3-13)	In-kind replacement of NSD outfall in accordance with WRDA '99 authorized project	Minor modification to in-kind replacement of NSD outfall in accordance with WRDA '99 authorized project Extension of new pipeline around east side of Pacheco Pond, with access road/berm.	Minor modification to in-kind replacement of NSD outfall in accordance with WRDA '99 authorized project. Extension of new pipeline around east side of expanded Pacheco Pond, with access road/berm.	Minor modification to in-kind replacement of NSD outfall in accordance with WRDA '99 authorized project Extension of new pipeline around east side of Pacheco Pond, with access road/berm.

	No Action	Alternative 1	Alternative 2	Alternative 3
New Levees (See SEIR/S, Figure 3-12 & 3-13)	As authorized	From enlarged Pacheco Pond to Novato Creek (central crossing levee); along east side of Pacheco Pond	Around east side of expanded Pacheco Pond' along north and south sides of the seasonal wetland; from BMK/HAAF berm to Novato Creek.	Along east side of Pacheco Pond; from enlarged Pacheco Pond to BMK south lagoon; and along BMK south lagoon to Novato Creek.
Improved Levees (See SEIR/S, Figure 3-12 & 3-13)	As authorized	BMK South Lagoon	BMK South Lagoon and portion of BMKV/HAAF; levee west of south lagoon lock	Western portion of BMK South Lagoon
Water Management Structures/ Pacheco Pond and BMK South Lagoon Connections	As authorized	Culverts with flapgates at Pacheco Pond; modified BMK lagoon overflow structures; culvert with flapgate in Novato Creek levee	Overflow structure from expanded Pacheco Pond to seasonal wetland; overflow structure from seasonal wetland to tidal wetland area; modified BMK lagoon overflow; and culvert with flapgate to Novato Creek from swale.	Culverts with flapgates at Pacheco Pond; pump station near BMK south lagoon lock
Bay Trail, Interpretive Center and Access Area	As authorized	Bay Trail along southwest perimeter of HWRP and north from City levee. Bay Trail along west side of Pacheco Pond to Bel Marin Keys Blvd. Spur option 1A between Pacheco Pond and Hamilton seasonal wetlands, and along central levee to Novato Creek. Interpretive Center and access area on property currently owned by the City of Novato west of the HWRP seasonal wetland area.	Bay Trail along southwest perimeter of HWRP and north from City levee. Bay Trail between Pacheco Pond and HAAF and between BMKV seasonal wetlands and Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill. Interpretive Center and access area on property currently owned by the City of Novato west of the HWRP seasonal wetland area.	Bay Trail along southwest perimeter of HWRP and north from City levee. Bay Trail between Pacheco Pond and HAAF seasonal wetlands, along east side of expanded Pacheco Pond to Bel Marin Keys Blvd. Spur Option 3A along new levee south of BMK south lagoon levee to Novato Creek. Interpretive Center and access area on northwest side of BMKV.
BMKV Upland Habitat Buffer	None	Upland habitat buffer area in swale south of BMK south lagoon.	Upland habitat buffer area in swale south of BMK south lagoon.	Upland buffer only in area south of the western portion of BMK lagoon.
PG&E Tower Footings	No Action Required	Jacketed to prevent erosion/corrosion	Same as Alternative 1	Same as Alternative 1

3.5.1 No-Action Alternative

Under the No-Action Alternative, the authorized HWRP, habitats would be restored at the HAAF, SLC and Navy Ballfields parcels using dredged material to accelerate marsh establishment and raise elevations for seasonal wetlands. This alternative would result in 950 acres of habitat. Ten million six hundred thousand (10,600,000) cubic yards of dredged material from various bay area projects would be used. No wetland restoration would take place at the BMKV site and no Bay Trail alignment would be constructed through the BMKV property.

Potential delays in habitat restoration at the SLC parcel (314 acres), the Navy Ball Fields (18 acres) and the seasonal wetland portion of HAAF may occur due to BRAC and FUDS issues.

Under this alternative, it is assumed that the Corps, Conservancy or their successors in interest would:

- allow agriculture to continue on the BMKV site for a few years, then implement fence maintenance and weed control programs;
- continue to operate and maintain drainage and pumping facilities on the site;
- maintain levees, and
- implement the Hamilton Wetland Restoration Project, including construction of a perimeter flood protection levee along the boundary between the HWRP restoration site and the BMKV parcel.

3.5.2 Alternative 1 – Dredged Material Placement with Enlarged Pacheco Pond

3.5.2.1 Restoration Features

Alternative 1 consists of the authorized Project and the BMKV increment. Figure 3-1 depicts Alternative 1 at maturity. Under Alternative 1, a diverse array of tidal (tidal marsh, tidal flat, and subtidal) and nontidal (high-transitional marsh, seasonal wetland, perennial wetland, perennial open water, and upland) habitat types would be restored to the project site. Imported dredged material that has been determined to be suitable wetland cover material according to DMMO requirements would be used to create upland and seasonal wetland habitats and to create surface elevations suitable to accelerate the initial establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored within the BMKV increment under Alternative 1 is shown in Table 3-3.

In the eastern portion of the BMKV parcel, three tidally influenced sub-basins, each approximately 400 acres in size, would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (approximately 1 foot below Mean High Water [MHW]) along the basin perimeter to approximately 0 NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the BMKV Parcel to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high transitional marsh vegetation. After fill placement activities have been completed, the outboard levees would be breached in three locations to

restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events. The levee along San Pablo Bay would also be lowered to create topographic diversity and facilitate the establishment of transitional marsh vegetation. Several high points along the levee will be left as high-tide refugia. Final marsh plain elevations would be established via natural deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final tidal wetland surface elevations in the three marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

A levee approximately 10 feet in elevation would be constructed across the northwestern portion of the BMKV parcel to separate the nontidal and tidal habitats. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the levee would be constructed with a gradual slope from a base elevation of 1 foot NGVD to a crest 10 feet NGVD. The existing levee along the BMK south lagoon would be improved (top elevation approximately 6 feet NGVD), and an overflow structure or structures would be installed to convey overflow from the lagoon into the swale area. Overflow from the lagoon and seasonal precipitation would support the establishment of seasonal wetland habitat in the swale located between the two levees. Plant species composition in this area would vary according to salinity, inundation frequency, and duration; however vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs.

In the northwestern portion of the BMKV parcel, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging Pacheco Pond. The levee that now separates the BMKV parcel from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open water habitat. The bottom elevation of Pacheco Pond would remain at the existing elevation of -3 feet NGVD, and the pond would continue to be managed to maintain a surface water level of approximately 1.5 feet. Sections of the levee would be left in place to provide roosting and nesting habitat for shorebirds. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent marsh vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin. A significant portion of existing Pacheco Pond storm runoff might be directed through the tidal marsh basin.

The salinity of the water in the channel flowing through the tidal marsh basin would vary, depending on the outflow from Pacheco Pond and the extent of tidal inundation. As water is released from Pacheco Pond following large winter storm events, salinities within the channel would vary from freshwater values near the overflow to brackish and marine levels as water flows into the marsh basin. During extreme high tides, the channel would be inundated by tidal flow and salinity would increase to near marine levels. The freshwater pond environment would not be affected during these periods because the flapgate would prevent tidal flows from entering the pond. During the summer months and dry times of the year, the salinity of water in the channel would be comparable to that found in San Pablo Bay.

Alternative 1 would include the installation of a new or retrofitted sanitary outfall pipeline along the berm (the existing alignment) that separates the expansion site from the adjacent HWRP parcel. The existing pipeline would be replaced or retrofitted because of differential settling and leakage. The new pipeline would be installed slightly below the grade of the existing pipeline; the existing outfall pipeline would be abandoned in place to provide protection from scour associated with the formation of tidal channels. The NSD pipeline would be realigned around the east side of the expanded Pacheco Pond.

3.5.2.2 Recreation Features

The authorized HWRP has a Bay Trail alignment along the City of Novato levee along the west side of the HWRP site. Alternative 1 would also include construction of public access facilities. Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field, along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh. The trail would follow either the existing road or new levee constructed for the HWRP until it meets the existing perimeter levee. The trail would then follow the path of the existing perimeter levee north and eastward. The Bay Trail also would be extended northward from the City levee along the west side of Pacheco Pond to Bel Marin Keys Boulevard. The trail would continue northwest along the western edge of the HWRP restoration area, proceed around the base of Ammo Hill on existing dirt roads, and cross the confluence of Pacheco and San Jose Creeks where they enter Pacheco Pond. This would require the installation of bridges, boardwalks, and/or other infrastructure. After crossing the confluence, the trail would follow the existing MCFCWCD service road and connect to Bel Marin Keys Boulevard via a boardwalk or bridge. This proposed alignment is outside lands currently owned by the SCC. If the selected plan includes this alignment of the Bay Trail and associated recreation features and there is any contamination on the required property, the non-Federal sponsor, SCC will adequately remediate the site for the project purpose. If the feasibility of locating recreation features on these parcels is not demonstrated, i.e., remediation issues are not resolved, the location of recreation features currently shown in Alternative 2 will be used.

Spur Option 1A (Figure 3-1) would include a spur trail eastward from the Bay Trail across the levee between Pacheco Pond and the HWRP, and along the proposed levee separating the upland buffer/swale area from the restored tidal wetlands to Novato Creek. This spur would terminate at Novato Creek, and a gate would be installed at the Novato Creek terminus to prevent trail users from entering the BMK residential community.

Final site-specific design of the new Bay Trail alignments has not been completed, but may include some of the following components (Questa Engineering 2001):

- Locating the trail on the mid-slope of the levee to minimize visual disruption of sensitive wildlife;
- Designing the trail to ensure a buffer between the trail alignment and sensitive habitat areas, and providing overlooks or vista points offering views of buffer zones and adjacent habitat areas;
- Installing fencing to prevent intrusion by humans and pets;

- Grading a topographic separation or constructing trail segments at low elevations relative to adjacent residential areas to provide privacy;
- Closing trail segments near nesting areas seasonally;
- Installing vegetative buffers to preclude access to sensitive areas;
- Installing a gated entry to exclude motorized vehicles; and
- Restricting dog access.

Additional public access facilities proposed under Alternative 1 include an interpretive center located east of Ammo Hill and south of the HWRP seasonal wetland restoration area. The interpretive center would be located along the road designated as the HWRP wetland restoration access road, and is conceptually envisioned as an approximately 1,000-square-foot building housing exhibits that provide information about the wetland restoration projects and the local flora and fauna. Restrooms and limited parking (approximately 10–20 spaces) would be provided. The interpretive center would serve as a trailhead and would be connected to the proposed Bay Trail alignment via new trails routed along existing dirt roads. The interpretive center is not a part of the federal project, and as such would be the full responsibility of the non-Federal sponsor.

3.5.2.3 Summary of Resultant Changes to Authorized HWRP

The following changes to the authorized HWRP would occur if Alternative 1 were implemented:

- Elimination of levee between BMKV and SLC parcels
- Replacement of levee between HAAF and SLC parcels with an access berm
- Rerouting the authorized realignment of the NSD outfall pipeline
- Increase and change in location of high transitional marsh on the SLC parcel

3.5.3 Revised Alternative 2 – Dredged Material Placement with Seasonal Wetlands and Expanded Pacheco Pond

After consideration of the comments provided by agencies, individuals, and organizations on the draft document, design requirements, and environmental factors, and review of the project goals and objectives, Alternative 2 was revised. The following outlines the major revisions made to the design of Alternative 2. Major features of Revised Alternative 2 are presented in Table 3-2. A detailed description of Revised Alternative 2 follows; a detailed description of Alternative 2, prior to modification, is presented in Appendix J.

- 1) Expansion of the swale south of the BMK south lagoon from 230 acres to 388 acres (including 247 acres of upland and 141 acres of seasonal wetland);
- 2) Addition of a 21-acre expansion of Pacheco Pond with a 12-acre emergent marsh;
- 3) Construction height of South Lagoon levee changed to 6 feet NGVD (designed to settle to design height of 5 feet NGVD) previously 10' NGVD);
- 4) Construction height of new levees from 12 feet NGVD to 10 feet NGVD (with settlement to design height of 8 feet NGVD);

- 5) Relocation of new outboard levee to 1500 feet south and east of the existing BMK south lagoon levee;
- 6) Improvements to the South Lagoon levee lock structure and levee west of structure to minimize Novato Creek bypass flows to south lagoon;
- 7) Removal of Spur Trail Option 2A to Novato Creek; routing of Bay Trail around west side of Headquarters Hill;
- 8) Relocation of the Interpretive Center and Access Area from BMKV to the City of Novato property on HAAF; and
- 9) Designation of primary construction road access from Hamilton and secondary access from Bel Marin Keys Boulevard.

Table 3-2 Summary of Revised Alternative 2: Dredged Material Placement with Seasonal Wetland and Enlarged Pacheco Pond

Habitats	899 acres tidal wetland and 120 acres other tidal habitats 277 acres seasonal wetland 247 acres upland
Outboard Levee Breaches	Novato Creek (BMKV); San Pablo Bay (BMKV)
Novato Sanitary District Outfall	Access road/berm (4–6' NGVD) and extension of 400' of new pipeline around east side of Pacheco Pond. Authorized HWRP already includes replacement/retrofit of existing pipeline and relocation of dechlorination plant.
New Levees	From enlarged Pacheco Pond to Novato Creek (8–10' NGVD). Along north and south sides of seasonal wetland (8–10' NGVD)
Improved Levees	Around east side of enlarged Pacheco Pond (8–10' NGVD) BMK south lagoon (5–6' NGVD)
Water Management Structures/Pacheco Pond and BMK S. lagoon connections	Culvert with flapgate from seasonal wetland to tidal wetland area Culvert with flapgate in Novato Creek levee to drain swale area Modified BMK lagoon overflow
Bay Trail, Access Area and Interpretive Center	Bay Trail along southwest perimeter of HWRP and north from city levee and along east side of Pacheco Pond to Bel Marin Keys Blvd around the west side of Headquarters Hill. Access Area on 2 acres of Bulge property west of HWRP seasonal wetland area. Interpretive Center on City land west of HWRP seasonal wetland area.

3.5.3.1 Restoration Features

Figure 3-2 depicts Revised Alternative 2 at maturity. Under Revised Alternative 2, tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, seasonal wetlands, upland) habitat types would be restored to the expansion site. Imported dredged material (determined to

be suitable wetland cover material based on DMMO requirements) would be used to create upland and seasonal wetland habitats, and to create surface elevations suitable to accelerate the establishment of tidal marsh vegetation. Final marsh plain elevations would develop over time through the natural deposition of sediments from San Pablo Bay, supporting the establishment of tidal marsh vegetation. The acreage of each habitat type restored within the BMKV increment under Revised Alternative 2 is shown in Table 3-3.

In the eastern portion of the site, two tidally influenced sub-basins, each approximately 600 acres in size (the southern basin includes the SLC site), would be created as cells to facilitate the placement of dredged material and the establishment of tidal marsh vegetation. Dredged material would be placed in each sub-basin to create surface elevations ranging from approximately 2 feet NGVD (approximately 1 foot below MHW) along the basin perimeter to approximately 0 NGVD near the outboard levee. Additional dredged material would be placed in the southeast corner of the SLC site to create surface elevations (approximately 3.5 feet NGVD) suitable for the establishment of high-transitional marsh vegetation. After placement activities have been completed, the outboard levees would be breached in 2 locations to restore the hydrologic connections to San Pablo Bay and Novato Creek. The levee along Novato Creek would also be lowered to facilitate overflow onto the expansion site from Novato Creek during peak storm events. The levee along San Pablo Bay would also be lowered to facilitate the establishment of mid-high marsh vegetation. Several small portions of the outboard levees will be left in place as high-tide refugia. Final marsh plain elevations would be established through the deposition of fine-grained sediments from San Pablo Bay and Novato Creek. Final surface elevations in the 2 marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD. Elevations in the channel bottoms would ultimately be lower, particularly at the breach.

A levee with an initial top elevation of approximately 10 feet NGVD (with a 2-foot settlement allowance, resulting in a design elevation of 8 feet NGVD) would be constructed across the middle portion of the site to separate the non-tidal and tidal habitats. The outboard (east) side of the levee would be constructed with a gentle side slope that would transition from upland to high- to mid-marsh habitat types. The inboard (west) side of the levee would slope gradually from the crest of 10 feet NGVD to a base elevation of approximately -1.5 to -1 foot NGVD in the bottom of the swale and approximately -1 to 0 feet NGVD in the seasonal wetland. The existing levee along the BMK south lagoon would be improved to an initial top elevation of 6 feet NGVD, which includes a 1-foot settlement allowance, resulting in a design elevation of 5 feet NGVD. This alternative includes an overflow structure or structures that would be installed to convey overflow into the swale area. Overflow from the lagoon as well as seasonal precipitation would support the establishment of approximately 141 acres of seasonal wetland habitat in the swale located between the 2 levees. Plant species composition in this area would vary according to salinity and inundation frequency and duration; however, vegetation would likely consist of emergent wetland vegetation (e.g., bulrushes, cattails, rushes), and grasses and forbs.

Under Revised Alternative 2, Pacheco Pond would be expanded by 21 acres on its eastern side. The expanded pond would also include 12 acres of emergent marsh habitat on its eastern border with the Bay Trail. A new levee would be constructed around the new eastern boundary of

Pacheco Pond. The existing Pacheco Pond levee would be breached in several locations to unify the existing and new portions of the pond. Several portions of the existing levee may be left in place to create habitat islands.

In the northwestern portion of the site, approximately 136 acres of seasonal freshwater wetlands (e.g., cattails, bulrushes, sedges) would be created by constructing surrounding levees to impound freshwater flows and by routing overflow from Pacheco Pond. The outboard levee would also prevent the seasonal wetland habitat area from being inundated during high tides. An adjustable weir would be installed in the new levee around the east side of the expanded Pacheco Pond levee to facilitate overflow into the seasonal wetland habitat area when surface water elevations in Pacheco Pond exceed 2 feet NGVD (the managed surface water elevation). A culvert structure would be installed in the new outboard levee to allow the release of overflow waters from the seasonal wetlands into the tidal marsh basin. A significant portion of Pacheco Pond flood flows may be released into the tidal marsh basin.

Under this alternative, Pacheco Pond would have 2 outlets: the existing outlet to Novato Creek via the outlet channel, and a new outlet to the seasonal wetland area on BMKV. CDFG and MCFCWCD have an existing agreement to manage Pacheco Pond for the dual purposes of flood control and wildlife. The BMKV expansion would include development of a new water management plan for Pacheco Pond, which the Conservancy or successors, CDFG, and MCFCWCD would jointly implement to continue to manage flood control and wildlife. The existing outlet would continue to operate and would receive all flow in summer (as the seasonal wetlands would not require summer flow). The new water management plan would determine the operational parameters of the two outlets in winter and during high-stage/flow events. The authorized HWRP includes the relocation of the NSD dechlorination plant and the replacement or retrofit of the existing NSD pipeline as described above under Alternative 1. This alternative includes construction of an access road/berm and construction of a new section (approx. 400 feet) of pipeline around the east side the expanded Pacheco Pond. NSD would access the pipeline by existing, new, or improved levees leading to an improved berm along the existing alignment (at the property line separating BMKV from HAAF). The top of the berm would be built to between 4 and 6 feet NGVD, which is similar to Alternative 1, except that under Revised Alternative 2, a 2,000-foot section southeast of Pacheco Pond would be built to between 8 feet and 10 feet NGVD because this portion of the levee would separate the seasonal wetland area from a part of the HAAF parcel that could receive tidal flow.

3.5.3.2 Recreation Features

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field, and then proceed along the southwestern perimeter of the HWRP to a point approximately 700 feet from the existing outboard marsh, as described above for Alternative 1.

Also under this alternative, the Bay Trail would proceed northward from the City of Novato levee along the western edge of the HWRP to Pacheco Pond, cross the levee between Pacheco Pond and the HWRP, proceed around the east side of the expanded Pacheco Pond and then proceed northward along the levee between Pacheco Pond and BMKV to Bel Marin Keys

Boulevard around the west side of Headquarters Hill. A permanent bridge would be installed to facilitate access across the new weir structure on the levee around the east side of expanded Pacheco Pond.

As part of the Federal project, an access area would be provided to the west of the HAAF panhandle, on a 2-acre portion of the Bulge parcel. Restrooms, limited parking (approximately 10 to 20 spaces) and an information display board would be provided. The Access Area would serve as a trailhead and would be connected to the proposed Bay Trail routes by new trails routed along existing dirt roads. Revised Alternative 2 does not include a spur trail option to Novato Creek. In addition, an interpretive center for the HWRP and BMKV expansion will be built by others and located adjacent to the access area. The site is on City of Novato property west of the seasonal wetland area at Hamilton in the same location as described above under Alternative 1. The interpretive center is conceptually envisioned as an approximately 1,000-square-foot building that would house exhibits that provide information about the wetland restoration projects and the local flora and fauna. The interpretive center is not a part of the federal project, and as such would be the full responsibility of the non-Federal sponsor.

3.5.3.3 Summary of Changes to Authorized HWRP

The following changes to the authorized HWRP will occur if Revised Alternative 2 is implemented:

- Elimination of levee between BMKV and SLC parcels
- Replacement of Levee between HAAF and SLC parcels with an access berm
- Repositioning of the breach location off the SLC parcel
- Increase and change in location of high transitional marsh on the SLC parcel
- Rerouting the authorized realignment of the NSD outfall pipeline.

3.5.4 Alternative 3 – Natural Sedimentation with Enlarged Pacheco Pond

3.5.4.1 Restoration Features

Alternative 3 consists of the authorized Project and the BMKV increment. Figure 3-3 depicts Alternative 3 at maturity. Under Alternative 3, a diverse array of tidal (tidal marsh, tidal flat, subtidal) and nontidal (high-transitional marsh, seasonal wetlands, perennial open water and upland) habitat types would be restored to the expansion site. Site soils and sediments would be used to establish the base for the high transitional marsh and upland transition on majority of the expansion site. On 90 acres of the southeastern corner of the SLC parcel, dredged material would be placed to establish high transitional marsh habitat. Final marsh plain elevations and vegetation would become established over time through the natural deposition of sediments from San Pablo Bay. The acreage of each habitat type that would be restored for the BMKV increment under Alternative 3 is shown in Table 3-3.

In the eastern portion of the site, two tidally influenced sub-basins, each approximately 700 acres in size, would be created as cells to facilitate the establishment of tidal marsh vegetation. The outboard levee would be breached in two locations to restore the hydrologic connection to San Pablo Bay. The BMKV parcel would initially consist of open water. Final marsh plain elevations would be established through natural deposition of fine-grained sediments from San

Pablo Bay. Final surface elevations in the two marsh sub-basins would range from approximately 0.5 to 3.5 feet NGVD.

A levee with an elevation of approximately 10 feet NGVD would be constructed along the northwestern portion of the site following the existing BMK south lagoon levee. The outboard (east) side of the levee would be constructed with a gently sloping bench, approximately 100 feet wide, to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat. The inboard (west) side of the levee would slope gradually from the crest of 10 feet NGVD to a base elevation of 5 feet below NGVD. The western portion of the existing BMK south lagoon levee near Bel Marin Keys Boulevard would be improved (approximate top elevation of 6 feet NGVD), and a seasonal wetland swale would be constructed between the levee and the expanded Pacheco Pond. A pump would be installed near the east navigation lock to convey overflow from the south lagoon into Novato Creek. A second bench, also approximately 100 feet wide, would be constructed along the north side of the existing levee that separates the BMKV parcel from the HAAF parcel, to protect the levee from wind and wave erosion and to create a band of high-marsh transition habitat.

In the northwestern portion of the BMKV parcel, approximately 50 acres of perennial open water and wetland habitat would be created by enlarging Pacheco Pond. The levee that now separates the BMKV parcel from Pacheco Pond would be breached in several locations to provide a larger contiguous area of open water habitat, and a new levee would be built further southeast. Sections of the levee would be left in place to provide nesting habitat for shorebirds. The bottom elevation of Pacheco Pond would remain at the existing elevation of -3 feet NGVD, and the pond would continue to be managed to maintain a surface water level of approximately 1.5 feet following enlargement of the pond. A bench would be constructed along the inboard perimeter of the new pond levee to promote the establishment of freshwater emergent vegetation. A culvert structure would be installed in the new pond levee to allow the release of overflow waters from the pond into the tidal marsh basin.

As for Alternative 1, the salinity of the water in the channel flowing through the tidal marsh basin would vary, depending on the outflow from Pacheco Pond and the extent of tidal inundation. As water is released from Pacheco Pond following large winter storm events, salinities within the channel would vary from freshwater values near the overflow to brackish and marine levels as water flows into the marsh basin. During extreme high tides, the channel would be inundated by tidal flow and salinity would increase to near marine levels. The freshwater pond environment would not be affected during these periods because the flapgate would prevent tidal flows from entering the pond. During the summer months and dry times of the year, the salinity of water in the channel would be comparable to that found in San Pablo Bay.

Under this alternative, a new or retrofitted outfall pipeline would be installed along the berm (the existing alignment) that separates the expansion site from the adjacent HAAF parcel. The existing pipeline would be replaced or retrofitted because of differential settling and leakage. The new pipeline would be installed slightly below the grade of the existing pipeline; the existing outfall pipeline would be abandoned in place to provide protection from scour

associated with the formation of tidal channels. The new NSD pipeline would be built in a new alignment around the eastern side of Pacheco Pond.

3.5.4.2 Recreation Features

Under this alternative, the Bay Trail would be extended southward from the terminus of the existing trail at the pump station near the Hamilton baseball field, along the southwestern perimeter of HWRP to a point approximately 700 feet from the existing outboard marsh. This trail alignment is similar to that described for Alternative 1. Public access also would be provided by a trail that follows the expanded Pacheco Pond levee, connecting the proposed Bay Trail segment along the southwest boundary of the HAAF parcel to Bel Marin Keys Boulevard. An optional spur of the Bay Trail would be located along the inboard side of the BMK south lagoon levee. This spur would terminate at Novato Creek, and a gate would be installed at the Novato Creek terminus to prevent trail users from entering the BMK residential area. Also under this alternative, an interpretive center for the Hamilton/BMKV Wetland Restoration Project would be constructed as described for Alternative 2. The interpretive center is not a part of the federal project, and as such would be the full responsibility of the non-Federal sponsor.

3.5.4.3 Summary of Resultant Changes to Authorized HWRP

The following changes to the authorized HWRP would result if Alternative 3 were implemented:

- Elimination of levee between BMKV and SLC parcels
- Replacement of levee between HAAF and SLC parcels with an access berm
- Rerouting the authorized realignment of the NSD outfall pipeline
- Increase and change in location of high transitional marsh on the SLC parcel
- Repositioning of the breach location off the SLC parcel
- Placement of approximately 2.6 mcy less dredged material on SLC parcel.

Table 3-3
Estimated Post-Restoration Habitat Acreages at the
Bel Marin Keys Expansion Site

Alternative	Subtidal	Tidal Mudflat	High Transitional Marsh	Tidal Marsh	Low Marsh	Seasonal Wetland	Freshwater Emergent Wetland	Open Water	Upland	Total
1	90	57	160	849	30	40	10	40	300	1,576
2, Revised	72	48	79	792	28	277	12	21	247	1,576
3	130	67	30	1,204	40	0	10	40	55	1,576

Notes:

Low marsh habitat = mean sea level to mean high water

Tidal mudflat habitat = mean lower low water to mean sea level (MSL \approx 0.61 NGVD)

Subtidal = internal aquatic habitat below mean lower low water